whether it can be caught on a rod, please, and if so with what bait?

SHILLONG, ASSAM,
February 3, 1942.

R. E. PARSONS, F.R.E.S.,
Indian Police.

XI.—ACCLIMATIZATION OF FOREIGN FISH IN TRAVANCORE.

All through the history of civilisation we find mention of Game fishing. This form of fishing was common even at the time of the ancient Greeks and Romans and is mentioned in many of their writings. Fishes for game purposes have been introduced in all countries at all times in history, and in more recent years with the application of Science to fisheries and their developments, they have been introduced for commercial and other divers purposes. The earliest and probably the first acclimatization ever recorded was that effected by the Romans at the time of Emperor Tiberius, when *Scarus* from the Carpathian Sea was introduced into the Ostian and Campanian shores.[1]

As early as the eleventh century Carp from Central Asia was introduced and acclimatized in European countries,[2] and by the middle of the nineteenth century acclimatization had become a common thing in all countries of the world. At one time it was held that introduction of exotic fish into countries was harmful to the indigenous species. Years of experience gained in all parts of the world have proved otherwise. Even inter-zonary acclimatizations have been carried out with remarkable success. A well known instance of acclimatization is the introduction of European and American Salmonidae into New Zealand in the year 1864.[3] This country, in spite of its unique flora and fauna and also its magnificent system of water ways, had no indigenous fish of commercial or sporting importance. But now certain rivers and streams there teem with trout. American fishes have been introduced into the Argentine Republic (1904) and then in European countries like Italy and Austria,[4] and even in the United Kingdom. Gourami, a native fish of the Malay Archipelago, was introduced into many countries such as Mauritius, Cayenne, Australia (1864), the

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[1] Radcliffe, W. (1926)—'Fishing from the Earliest Times', pp. 159-61. (London, 1926).

[2] Chambers, W. O. (1883)—*The Fisheries Exhibition Literature,* vol. xi, part iv, pp. 489-97.

[3] Ayson, L. F. (1908)—*Bull. of the U. S. Bureau of Fisheries,* vol. xxviii, part ii, pp. 968-73.

[4] Ayson, L. F. (1908)—*Bull. of the U. S. Bureau of Fisheries,* vol. xxviii, part ii, pp. 949-54.

Philippines (1927) and Ceylon (1908).[1] These are but a few of the well known instances from other parts of the world. In India, too, instances of such introduction are not wanting. Brown trout and rainbow trout were introduced in the rivers of Punjab (1909)[2] and in the Nilghiris in Madras (1866 .[3] Gourami from the Malay Archipelago, and *Gambusia*, a species of Top Minnow from America, have also been introduced in different parts of India. Attempts at the introduction of 'Barbados Millions', however, have not been successful.[4]

In Travancore, the importance of game fishing was realised only by a small percentage of the population, namely Europeans, mostly resident planters of the high range hills. The Department of Fisheries, which had until recently been a purely administrative body was amalgamated with the recent scientific research section only a couple of years ago. Consequently, all attempts at acclimatization hitherto have been undertaken by other agencies such as the Munnar Game Association and the Department of Public Health. The resident planters of the State took the initiative by introducing trout into the country and their attempts are still being continued with vigour. Their enterprise has cost a good amount of money and all the necessary funds have been raised through private donations.

Trout.

Acclimatization of foreign fish in this State dates back to 1906, when the introduction of Trout was first attempted by the Munnar Game Association. The Kannan Devan Hills, at the north-eastern extremity of Travancore, having an altitude ranging for 4000 to 8000 feet above sea level and forming a part of the main chain of the Western Ghats, were selected for this purpose. This part of the country lies roughly between 77° and 77° 20′ East Longitude and 9° 55′ and 10° 20′ North Latitude and is absolutely mountainous and covered over with evergreen forests and mountain slopes converted into extensive Tea Plantations. Its numerous valleys are strewn with small rivers, streams, waterfalls and lakes which are fed by the heavy annual rainfall ranging from 113 to 153 inches.

Between 1906 and 1916, eggs of Brown Trout (*Salmo fario*) were brought down four or five times from Scotland at great cost, hatched out at Chundavurrai and planted in the rivers and streams of Kundale Valley (6118 ft.) and Nymakad (6043 ft.)

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[1] Roxas, H. A. and Umali, A. F. (1937)—*The Philippine Journal of Science*, vol. 63, No. 4, pp. 433-82.

[2] 'Report on the Trout cultural operations in the Punjab and Native States under its control for the period Oct. 1912 to March 1914.' (Lahore, 1914.)

[3] Molesworth and Bryant, J. F.—*Journ. of Bombay Nat. Hist. Soc.*, vol. xxvii, pp. 898-910.

[4] Prashad B. and Hora, S. L. (1936)—*Records of the Malarial Survey of India*, 6, iv, pp. 631-48.

within the Kannan Devan Hill Concessions. In 1916, eggs of Rainbow Trout (*Salmo irideus*) were obtained from the Government hatchery at Ooty, through the late Mr. H. C. Wilson, Pisciculturral Expert to the Government of Madras and planted in the above streams. Brown Trout were found to thrive with great difficulty and specimens weighing upto six pounds have been taken from Munnar stream and the Eraviculam stream in Hamilton's Plateau (Eravimala).[1] This latter place which is at an altitude of about 7800 feet above sea level and has a very low temperature proved a suitable breeding place for this fish, and in 1918 some of them were observed to breed.

In order to protect the fish in the above areas from poachers and other destructive agencies, the Travancore Government at the request of the High Range Angling Association, closed in 1921, all the streams and lakes within the limits of the aforesaid Concessions for fishing at all times of the year except under a licence issued by the Commissioner of Deviculam in consultation with the Secretary of the said Angling Association.

The attempts at acclimatization of trout between 1906 and 1916 were, however failures, and between the years 1921 and 1932 there was a lull in the attempts. In 1932 on the initiative of some of the planters, a few hundred Rainbow trout fry were successfully brought by lorry from the Avalanche hatchery in the Nilghiris and liberated in a number of sluggish ponds at Chittavurrai (7096 ft.). Though these ponds served as temporary abodes for these fish, they proved in the long run to be quite unsuitable, owing to the lack of clear running water and enough moving space. The fry showed a tendency to abnormal increase in weight and after the first year ceased rising to the fly and subsequently died. Thus these attempts also proved futile.

In 1933, a hatchery was constructed at Arivikad (6057 ft.), and between 1933 and 1937, the Deviculam lake and the Loch Finlay were repeatedly stocked with trout fry. In the former lake the introduction proved quite a success although there was no evidence of the trout breeding during that period. Several good catches of fish were recorded, the heaviest taken being about 4 lbs. in weight. Unfortunately, owing to unsuitable location the hatchery proved a failure in spite of the earnest efforts of the authorities concerned to resuscitate it, and was subsequently closed down in 1937. The stock fish in the hatchery ponds, about 170 in number, were liberated in the streams of Hamilton's Plateau, which had by then been definitely proved to be an ideal home for these fish.

In December 1940, definite proof of the breeding of trout in the waters of Hamilton's Plateau was obtained. As it was thought that further stocking was necessary, 10,000 eggs (Rainbow trout) were purchased from the hatchery at Nuwara Eliya in Ceylon and were brought by 'plane to Trichinopoly and thence

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[1] There are conflicting views about this in the reports of the Hon. Secretaries of the High Range Angling Association then and now.

by car to Thaliar. From the latter place the chest containing the ova was brought in slow stages to Hamilton's Plateau, where the ova were hatched out by the 'riverbox' method, and the 5,000 fry thus obtained planted in the waters of the Plateau. At present there is ample evidence to show that a majority of these have come through to maturity. Again in January 1941, a second consignment of 5,000 eggs of the same fish was brought by 'plane from Ceylon. But this time many delays and difficulties in transport resulted in a high percentage of mortality. Nevertheless, the rest of the lot was hatched out by the same method at Rajamallay (7738 ft.), and the 1,300 fry obtained were planted at Devikulam and Chittavurrai. A hatchery which has now been completed (Nov. 1941) at Rajamallay will begin to function as soon as the ova ordered from Ceylon have been received.

Trout acclimatization in Travancore is still in an experimental stage and may take some more years before it reaches perfection. However, the results of past experiments have been encouraging, and the Associations concerned in this enterprise are optimistic about their success in the near future. Based on the results of 'plants' of fry made in the past couple of years, it is anticipated that in 1943 the High Range Angling Association will be in a position to take ova from its own stock of fish, with the result that future importations will decrease.

Top-minnow.

In 1937, the Department of Public Health introduced into this country, a species of American Top-Minnow, named *Gambusia affinis* (Baird and Girard) for malaria control work. This small viviparous, cyprinodont fish is a native of the south-eastern Atlantic coast of the United States of America, extending as far north as Maryland, and is usually found in great numbers in the shallow margins of lakes, ponds and streams in the tide water regions, where there is aquatic or semi-aquatic vegetation, and also in shallow ditches and surface drains. On account of its high efficiency as a destroyer of mosquito larvae thereby controlling malaria and yellow fever, it has been introduced into many parts of the world. In this State, this fish was introduced from Mysore, where it was brought from Italy in 1928 by Dr. B. A. Rao.

The first consignment of *Gambusia* was brought to Travancore in February 1937, but due to the sudden change of temperature and the imperfect transport arrangements, most of these died soon after arrival here. Only about hundred and fifty specimens survived. About 600 to 800 fish, which were brought with more care a second time in July 1938, were introduced into the rearing ponds of a hatchery constructed at Perungadavila, an important malarial centre, three miles away from the town of Neyyattinkara. They have happily acclimatized themselves to the climatic and other conditions in this country and are at present thriving well in three specially constructed rearing ponds at the above mentioned place. The District Health Unit at Neyyattinkara was experimenting on the efficiency of this fish as a destroyer of Anopheline

larvae under local conditions, and finding its utility in limited bodies of water free from vegetation, has stocked all the wells in the malarial districts with a limited number of fish. The Health Unit is contemplating the extension of this scheme to other malarial centres as well.

Gourami.

The Department of Marine Biology and Fisheries has now undertaken to introduce the Giant Gourami, (*Osphronemus gourami* Lacépède), into the State, and the preliminary arrangements such as the construction of the pond system, etc., are in progress. It is proposed at present only to experiment on the possibilities of acclimatizing the fish over here, and later on the basis of these experiments it is proposed to launch out a commercial project. This fish, as mentioned in an earlier part of this note, is a native of the Malay Archipelago and is essentially vegetarian and therefore neither predaceous nor cannibalistic. Being a labyrinthine fish, it is able to carry on aerial respiration as well as to resist considerable pollution of water. On account of such simple habits and extreme adaptability, it has earned the name of 'poor man's fish'. It was introduced into Madras in 1886 and there is no reason why it should not be a success here too. Dr. A. W. C. T. Herre, of Stanford University, California, who had done a lot of work on this particular fish, was on a visit to this country in January 1941, and when consulted on this subject remarked that the topographical and meteorological conditions of this country being almost identical with that of the Philippines; acclimatization of Gourami is bound to be a success. If this proves correct, it may enable us, to a considerable extent, to make such a cheap and nutritious article of food as fish, accessible even to the poor living in the interior of the country.

In concluding, I have to express my deep indebtedness to Mr. E. H. Francis of the Kannan Devan Hills Produce Ltd., and to Mr. W. S. S. Mackay, Hon. Secretary of the High Range Angling Association for kindly placing at my disposal some valuable data regarding trout in the High Range, and also to Dr. C. C. John, Professor of Marine Biology and Fisheries for kindly going through the manuscript of this note and making necessary corrections.

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Travancore,
February 20, 1942.

XII.—ON THE ROLE OF *ETROPLUS SURATENSIS* (BLOCH) AND *ETROPLUS MACULATUS* (BLOCH) IN THE CONTROL OF MOSQUITOES.

The use of fishes in the control of mosquitoes varies according to their feeding habits. Certain herbivorous species are helpful in